

## A Self-determination theory based intervention to promote healthy eating and physical activity in school-aged children

Una intervención basada en la teoría de la autodeterminación para promover la alimentación saludable y la actividad física en los niños en edad escolar

Uma intervenção baseada na teoria de auto-determinação para promover a alimentação saudável e atividade física em crianças em idade escolar

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**Resumen:** Niñez sobrepeso y obesidad en niños y niñas está alcanzando proporciones epidémicas en el mundo entero, Italia incluida. La obesidad infantil se ha relacionado con consecuencias perjudiciales para la salud. Hay una necesidad de desarrollar intervenciones teoría basada y rentables para promover la alimentación saludable y la actividad física con el objetivo de reducir la obesidad. El propósito de este estudio fue evaluar una intervención basada en la teoría de largo plazo para promover estilos de vida saludables en niños en edad escolar de escasos recursos. Se adoptó un diseño cuasi experimental, con el fin de evaluar la eficacia de la intervención, teniendo en cuenta la información de sus padres. Se pide a los padres para evaluar a sus hijos la actitud, la motivación y el comportamiento con respecto a los comportamientos relacionados con saldo de dos energías. Los resultados indican que los alumnos que participan en la intervención tenían más probabilidades de hacer actividad física en el tiempo libre y tienen actitudes más positivas hacia el ejercicio en comparación con el grupo control. Acerca de los hábitos alimenticios, los niños que participaron en la intervención eran más propensos a elegir alimentos saludables y menos propensos a elegir alimentos ricos en grasas en comparación con el grupo control. Los cambios en la actitud y la motivación entre el inicio y el seguimiento y los dos grupos se muestran también, aunque no significativamente. A pesar de varias limitaciones en el diseño, este estudio proporcionan más apoyo al argumento de que las intervenciones basadas en teoría de la autodeterminación podrían resultar en cambios significativos que afectan a su salud significativamente. **Palabras clave:** Teoría de la autodeterminación; intervención; alimentación saludable; actividad física; niños de las escuelas primarias;

**Abstract:** Childhood overweight and obesity in both girls and boys is reaching epidemic proportions over the world, Italy included. Childhood obesity has been linked to deleterious health consequences. There is a need to develop theory based and cost-effective interventions to promote healthy eating and physical activity with the aim to reduce obesity. The purpose of this study was to evaluate a long-term theory-based intervention to promote healthy lifestyles in underserved school-aged children. A quasi experimental design was adopted, in order to evaluate the effectiveness of the intervention, considering information from their parents. Parents were asked to rate their children attitude, motivation and behavior regarding two en-

ergy balance-related behaviors. Results indicate that pupils involved in the intervention were more likely to do physical activity in leisure time and have more positive attitudes toward exercise compared to the control group. About eating habits, children involved in the intervention were more likely to choose healthy foods and less likely to choose fat foods compare to the control group. Changes in attitude and motivation between the baseline and the follow up and the two groups are also shown, even if not significant. Despite several limitations in the design, this study provided further support to the argument that Self-determination theory-based interventions could result in meaningful health-behavior changes.

**Keywords:** Self-determination theory; intervention; healthy eating; physical activity; primary school children.

**Resumo:** Infância sobrepeso e obesidade em meninas e meninos Ambas está atingindo proporções epidémicas no mundo inteiro, Itália incluído. Infância a obesidade tem-se ligado a consequências para a saúde deletérios. ere a necessidade de desenvolver a teoria com base e de custo-e intervenções ective para promover saudável comer e atividade física Com o objetivo de reduzir a obesidade. e efeitos de estudo ESTA foi avaliar uma intervenção baseada na teoria de longo prazo para promover estilos de vida saudáveis em crianças em idade escolar carentes. Um projeto quase-experimental foi adotado, a fim de avaliar o ectiveness da intervenção, considerando as informações de seus pais. Os pais foram convidados a avaliar sua atitude infantil, motivação e comportamento em relação dois comportamentos relacionados com o balanço de dois energia. Os resultados indicam que alunos envolvidos na intervenção eram mais propensos a fazer atividade física no tempo livre e têm atitudes mais positivas em relação ao exercício comparado ao grupo controle. Sobre os hábitos alimentares, as crianças na intervenção envolvidos eram mais propensos a escolher alimentos saudáveis e menos propensos a escolher alimentos ricos em gordura comparar com o grupo de controle. Mudanças de atitude e motivação Entre a linha de base e o acompanhamento e os dois grupos são mostrados Além disso, mesmo que não seja significativa. Apesar das limitações na concepção Vários, Este estudo forneceu ainda apoio ao argumento de que intervenções baseadas em teoria da autodeterminação poderia resultar em mudanças de comportamento de saúde significativos.

**Palavras-chave:** teoria da autodeterminação; intervenção; alimentação saudável; atividade física; da escola primária crianças.

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## Introduction

Childhood overweight and obesity in childhood have rapidly increased worldwide and it is expected to increase even more in 2020 (de Onis, Blossner, & Borghi, 2010). Obesity in children is a risk factor for health and it has been linked to deleterious consequences in terms of social and psychological development (Puhl & Latner, 2007). As evidences have shown, combine diet and physical activity intervention may help to prevent children to become overweight and obese (Brown & Summerbell, 2009). A large number of interventions have been developed with the intention to promote health-related behavior in children and the majority of them have taken place in school-based settings (Sharma, 2007; Waters et al., 2014). As highlighted by Sharma (2007), primary school settings are the most ideal settings for school-based intervention, intervention should target improvement of physical activity, healthy nutrition and reduction of sedentary behaviors and they have to be based on solid theories. A number of different theories have been used to promote health-related behaviour in school settings. One of them is Self-Determination Theory (SDT, Deci & Ryan, 2000).

### Self-Determination theory

SDT is a motivational theory that has received large support in predicting health-related behaviour and in supporting health behaviour change (Fortier, Williams, Sweet, & Patrick, 2009). This theory proposed a continuum from intrinsic to extrinsic motivation. Intrinsic motivation involves engaging in behaviour for its own sake unlike extrinsic motivation involves doing an activity because it is instrumental to achieving a goal. Accordingly to SDT, individuals can become more autonomous (or self-determined) to engage in behaviours over time as their reasons become more internalized (internalization of motivation). Internalization refers to the natural active process whereby a behaviour that was initially prompted by external sources is regulated with an experience of autonomy and sense of competence (Deci & Ryan, 2008). According to this theory, individual basic psychological needs for autonomy, relatedness and competence, that are assumed to enhance more autonomous motivational patterns, can be supported by social environment (Deci & Ryan, 2008).

The facilitation of this internalization process can, in turn, enhance autonomous motivation and consequently health behaviour engagement and persistence (Deci & Ryan, 1985). Essentially, intervention strategies can be developed and implemented to satisfy the three basic psychological needs fostering internalisation and positive behaviour change. Generally, the purpose of SDT intervention is to assist individual's progress on the continuum towards more autonomous forms

of motivation (Fortier, Duda, Guerin, & Teixeira, 2012). Self-determination theory (SDT) represents a solid approach to consider in order to promote health-related behavior. A growing body of research has demonstrated the importance of autonomous motivation for a range of health behaviors, such as physical activity, smoking cessation, control of diabetes, dental care and healthy eating (Halvari, Halvari, Bjornebekk & Deci, 2012; Silva et al., 2010; Williams et al., 2011; Girelli, Hagger, Mallia, Lucidi, 2016). Self-determination theory-based interventions have demonstrated to be effective in different health domains, such as physical activity (Fortier, Duda, Guerin, & Teixeira, 2012), eating a healthy diet (Williams, Grow, Freedman, Ryan & Deci, 1996), smoking cessation (Williams et al. 2006), alcohol reduction (Ryan, Plant, O'Malley, 1995), and medication adherence (Williams et al. 1998). In the Italian context, many studies provided empirical support for the validity of the SDT model in school settings (Alivernini & Lucidi, 2008; Alivernini, Lucidi & Manganelli, 2008; Alivernini & Lucidi, 2011, Alivernini, Lucidi & Manganelli, 2011, Alivernini, 2013; Alivernini & Manganelli, 2016). A large number of intervention based on Self-Determination theory have been conducted to promote physical activity but few of them have been conducted in a school setting (i.e. Chatzisarantis & Hagger, 2009). The study found that SDT provides a useful framework for the development of school-based intervention to promote physical activity participation in leisure time. However, none of these studies included healthy eating as target behaviour in the intervention and none of these studies has been conducted in Italy. The present study aims to investigate the effectiveness of a Self-Determination theory based intervention conducted in Italy to promote healthy lifestyles in primary school-aged children in terms of increasing physical activity and healthy eating habits.

## Method

### Procedure

The "Ready, Steady, Go!" ("Pronti, Partenza, Via!", PPV) intervention According to Self-Determination Theory (SDT, Deci & Ryan, 2000), the PPV intervention has been developed with the aim to enhance children motivation toward physical activity and healthy eating supporting their basic needs for autonomy, competence and relatedness in order to enhance active lifestyles and energy-balance nutritional behaviour in underserved school-aged children. The intervention was carried out over the whole school year (9 months) with a minimum of 2 h per week and delivered by teachers and volunteers of local associations during school time. It was focused on both target behaviours, physical activity and healthy eating, devoting the same amount of time (1 hour/

week) to each of them. Children were provided with the opportunity to play games in which they could eat healthier and be more active. For example, they were asked to prepare a meal with the highest number of colors possible. Or they were involved in some traditional Italian games, like “Witch Says Colors”, in which they were encouraged to move and the game topic was adapted to food topic<sup>1</sup>. In a second step, children were encouraged to create their own games and to propose their games to their class. The control group received only a seminar about the benefits of eating healthy and being more active. Both volunteers and teachers received specific trainings before the intervention delivery. In particular, they were trained to guide children in an autonomy-supportive manner so that they were equipped to create a social context supportive of autonomous forms of motivation. The intervention was based on a previous intervention developed also in Italy by a group of scholars working at Sapienza, University of Rome: “Let’s get moving” (“Diamoci una mossa”, DUM; Mamei, Galli, Dilillo, Alemanno, Catalani, et al., 2014). The intervention materials for teachers and volunteers were partly based on the previous DUM intervention and partly developed for the PPV intervention.

### Design and Participants

Considering the classroom as unit of analysis, a quasi-experimental design was implemented with the outcomes measured in two points in time (pre and post intervention) and a comparison with a control group formed basing on similarity with the experimental group on the main characteristic (demographic variables). Several schools over the whole country were involved in the intervention and the 50% of them were randomly selected for the evaluation. Schools from a region in the centre of Italy were involved in the evaluation procedure as control group. This procedure resulting in the targeting of 23 classrooms, from 10 schools composed totally of 579 children for the intervention group, aged 6-11, M age: 8,21, 49,6% male) and 19 school classes from 4 schools, composed of 477 children for the control group (aged 6-11, M age: 8,78, 47,5 % male). For the intervention group, 2 school classes were selected for each school, besides for one school, where 3 school classes were selected. For the control group, 5 school classes were selected for each school except for one school only 4 school classes were selected. On average, the number of pupils for each school class was 25.

For both groups – intervention and control - questionnaires were given to the children to take home to their par-

ents<sup>2</sup>. Parents were asked to complete a questionnaire about their children attitude, motivation and behaviour in the two investigated areas: healthy eating and physical activity

### Measures

A questionnaire, included demographic measures and indexes of attitude, motivation and behaviour, was developed for the purpose of this study. This questionnaire was firstly tested on a sample of 90 people, using the “Think Aloud” technique: the distributive properties of the questionnaire were evaluated and the items that were problematic in the analyses have been reformulated or discarded. In this final version of the questionnaires, a simple scenario was presented. Parents were asked to imagine a situation in which their children would have been free to choose what to do in different situations related to the main contexts: eating and physical activity. Parents were then asked to rate the extent to which their children would have enacted that behaviour. A first study to test the reliability of the measures was implemented and will be published elsewhere. The indexes and scales are presented below.

*Attitude toward physical activity* refers to the positive attitude that, as reported by parents, their children have towards daily physical activity. It was assessed by 6 items. Parents were presented with a common stem. “My child thinks that going to school by walking is...” then a list of 6 adjectives was presented. For each adjective, parents were asked to rate from 0 (not at all) to 10 (at all) how much their children would consider, respectively, fun, healthy, tiring, boring, useless, enjoyable. The score is much higher as more, accordingly to parents, their children consider going to school fun, healthy and enjoyable instead of tiring, boring and useless.

*Motivation toward physical activity* refers to the expectations reported by parents about how much their children would want to do moderate exercise in their spare time. Parents were asked to rate the extent to which their children would like to do exercise in their spare time from 1 (he/she wouldn’t like to do it at all), to 5 (he/she would be really enthusiastic). The score is much higher as more, accordingly to parents, their children would be motivated to do it.

*Daily moderate exercise* refers to the expectations reported by parents about how much time their children would spend in moderate exercise in their daily life. Parents were asked to rate the extent to which their children would do moderate exercise (doing exercise, for example) in their spare time from 0 (not likely at all) to 10 (extremely likely).

1 With a counting out rhyme, a “witch” is selected. The witch calls out a colour, all the players must go and touch a food of that colour, but it has to be a healthy food. The game ends when the witch touches a player before he/she can touch the wanted colour.

2 Each children receive a questionnaire to take home to their parents. Parents were then contacted by teachers and volunteers in order to guarantee they have received the questionnaire and to give them instructions about how to return it (in a sealed envelope).

*Daily sedentary activities*: refers to the expectations reported by parents about how much time their children would spend in sedentary activity in their daily life. Parents were asked to rate the extent to which their children would be engaged in sedentary activities (watching TV, for instance) in their spare time from 0 (not at all likely) to 10 (extremely likely).

*Attitude toward healthy food consumption* refers to the positive attitude that, as reported by parents, their children have towards healthy food consumption. It was assessed by 6 items. Parents were presented with a common stem. "My child thinks that eating fruit for snack is..." then a list of 6 adjectives was presented. For each adjective, parents were asked to rate from 0 (not at all) to 10 (at all) how much their children would consider that behaviour, respectively, right, tasty, unpleasant, silly, normal, weird. The score is much higher as more, accordingly to the parents, their children consider eating fruit as snack right, tasty or normal instead of silly, unpleasant and weird.

*Motivation toward healthy food consumption* refers to the expectations reported by parents about how much their children would want to buy healthy food for breakfast. Parents were asked to rate the extent to which their children would like to buy different types of food (healthy and unhealthy) from 0 (not likely at all) to 10 (extremely likely). The score is much higher as more, accordingly to the parents, their children would like to buy healthy food instead of unhealthy food for breakfast.

*Daily healthy food consumption* refers to the expectations reported by parents about their children vegetables consumption in their daily life. Parents were asked to rate the extent to which their children would eat vegetable for dinner, if they could choose, from 0 (not at all) to 5 (at all).

*Daily high-calorie snack consumption* refers to the expectations reported by parents about their children high-calorie snack consumption in their daily life. Parents were asked to

rate the extent to which their children would eat high-calorie snack from 0 (not at all) to 5 (at all).

*Skipping breakfast* refers to the expectations reported by parents about whether their children would skip breakfast in their daily life. Parents were asked to rate the extent to which their children would skip breakfast from 0 (not likely at all) to 10 (extremely likely).

#### Data analysis

A series of 2 (time: pre vs. post) x 2 (group: experimental vs. control) mixed-design factorial ANOVA on each index were conducted. Descriptive and exploratory analyses of physical activity and eating habits were performed within and between groups. Correlation and multiple regression analyses were conducted to test models consistent with the research hypothesis. The reliability of each scale has also been assessed. Analyses of intervention effects and all descriptive analyses were conducted in SPSS 19.0.

## Results

#### Descriptive statistics

In total, 477 participants for the intervention group (67% retained), and 389 participants for the control group (65% retained) completed both the baseline and post-intervention questionnaire. One way analysis of variance performed on pre-intervention behaviour and on gender and age revealed no significant differences between control and experimental group, suggesting similarity on the main characteristics. Descriptive statistics of all indexes and scales used in the study, Cronbach's alpha reliability estimates and goodness of fit indexes of multi-item scales are reported in Table 1.

**Table 1.** Descriptive statistics for all the study measures. Reliability coefficients and goodness of fit for the multi-item scales of the study.

Indexes and scales	Means	SD	Cronbach's Alpha	Goodness of fit	
				CFI	RMSEA
Attitude toward physical activity	67,79	22,14	.86	.94	.05
Motivation toward physical activity	88,56	20,65			
Daily moderate exercise	82,82	18,52			
Daily sedentary activities	56,39	25,56			
Attitude toward healthy food consumption	67,29	23,87	.86	.95	.04
Motivation toward healthy food consumption	55,57	15,72	.67	.93	.06
Daily healthy food consumption	54,01	32,89			
Daily high-calorie snack consumption	41,75	35,78			
Skipping breakfast	10,19	23,24			

### Intervention effects

Table 2 illustrates the means in pre and post intervention, for both intervention and control group. Table 3 shows the statistically significant results of the effects of the interaction between group and time of the 2 (time: pre vs. post) x 2 (group: experimental vs. control) mixed-design factorial ANOVA for each index/scale. Results regarding the two domains (physical activity and healthy eating) will be described separately. Regarding physical activity, a statistically significant interaction between group and time has been found in Attitude ( $F_{(1,525)} = 3,91; p < 0,05$ ) and in daily moderate exercise ( $F_{(1,505)} = 7,137; p < 0,01$ ). Children involved in the intervention showed a more positive attitude toward physical activity and would spend more time in moderate exercise in their free time, as reported by their

parents, compared to the control group. No statistically significant interaction effects were found in motivation toward physical activity and daily sedentary activities either. However, in both contexts, results shown a trend in line with the research hypothesis. Regarding healthy eating, a statistically significant interaction between group and time has been found in daily healthy food consumption ( $F_{(1,523)} = 14,18; p < 0,01$ ) and in daily high-calorie snack consumption ( $F_{(1,519)} = 8,18; p < 0,05$ ). Children involved in the intervention would eat more healthy food and less high-calorie snack consumption after the end of the intervention, as reported by their parents, compared to the control group. No statistically significant effects were found in attitude and in motivation toward healthy food consumption and in skipping breakfast. However, in all behaviours, results showed a trend in line with the research hypothesis.

**Table 2.** Means for each Index for Intervention and Control groups at Pre and Post-Intervention.

Variables	Intervention N = 477		Control N = 389	
	pre	post	pre	post
Attitude toward physical activity	67,7	69,8	65,2	65,8
Motivation toward physical activity	88,56	89,96	87,6	88,2
Daily moderate exercise	84,6	89,2	80,3	81,1
Daily sedentary activities	56,7	56,9	55,89	55,28
Attitude toward healthy food consumption	67,6	68,0	65,6	65,7
Motivation toward healthy food consumption	55,5	56,4	55,5	54,8
Daily healthy food consumption	56,3	59,3	51,1	51,3
Daily high-calorie snack consumption	40,37	37,35	43,4	43,8
Skipping breakfast	10,1	9,9	11,8	12,3

**Table 3.** Mean and statistically significant effects of the interaction\* between group and time of the 2 (time: pre vs. post) x 2 (group: experimental vs. control) mixed-design factorial ANOVA.

Variables	Intervention N = 477		Control N = 389		F	$\eta^2p$	p
	pre	post	pre	post			
Attitude toward physical activity	67,7	69,8	65,2	65,8	3,919	0.04	.04
Daily moderate exercise	84,6	89,2	80,3	81,1	7,137	0.05	.006
Daily healthy food consumption	56,3	59,3	51,1	51,3	14,18	0,06	.003
Daily high-calorie snack consumption	40,37	37,35	43,4	43,8	8,18	0.04	.04

\* The main effects for all indexes/scales and interactions effects for Motivation toward physical activity, Daily sedentary activities, Attitude toward healthy food consumption, Motivation toward healthy food consumption and Skipping breakfast were not statistically significant so they were not reported in the table.

### Discussion

In a recent review, Han et al, (2010) highlighted that, although many dietary behaviour interventions were successful, they were unlikely to be replicated because they

lacked solid theories concerning how behaviour change has been induced. Furthermore, some interventions could improve the risk of social stigma and stereotypes associated with overweight and obesity and therefore can worsen the body image and social adaptation of children and adolescents con-

sidered “fat”. It is in line with this theoretical concepts that the intervention has been designed. The purpose of the present study was to evaluate a self-determination theory based intervention in a school setting. The intervention aimed to promote healthy lifestyles in primary school-aged children in terms of increasing physical activity and healthy eating habits. The opportunity to be more active and to eat healthier was offered to the children as a game. Then, trying to make them more independent, they were asked to create their own games. As expected, the intervention group significantly improved their daily moderate exercise and their attitude toward physical activity, compared to the control group. These results are consistent with tenets of self-determination theory and previous research (Ryan & Deci, 2000; Hagger et al., 2009), and suggest that our one-year intervention was successful in enhancing pupils’ attitude toward physical activity and physical activity in itself. Furthermore, the fact that pupils of the intervention group reported greater consumption of healthy food and less consumption of unhealthy food daily, is also consistent with tenets of self-determination theory (Ryan & Deci, 2000). This study provides an original contribution to knowledge for three main reasons. First, it evaluates a self-determination-theory based intervention aimed to promote both physical activity and healthy eating in a school setting in an Italian context. Second, it is the first of its kind to con-

sider pupils aged 6-11. Third, the present study is the first to propose to children to move and to eat healthier as a game.

## Practical applications

Although our study demonstrated effects of a long intervention programme on healthy eating and physical activity, it is not without limitations. One limitation has to do with the lack of randomisation. Specifically, it was not possible to allocate schools and school classes to the intervention or the control group. However, the preliminary analysis revealed no significant differences between the two groups. In addition, the measures used in this study have not been validated before in a large sample. However, as stated above, the indexes and scales used were tested before with the “Think Aloud” technique and the descriptive statistics of the scales demonstrated good reliability and good fit. Last but not least, information provided by parents has been used to obtain data on their children, which may have led to some over-reporting. However, this potential bias was minimised by the use of a control group that would have responded in a similar way.

Despite these limitations, results showed the intervention to be successful in improving healthy lifestyles in physical activity and healthy eating behaviours in school-aged children in an Italian school setting.

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